

# CARNEGIE COMMISSION ON SCIENCE, TECHNOLOGY, AND GOVERNMENT

A MIDPOINT REPORT TO THE  
CARNEGIE CORPORATION BOARD

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CARNEGIE  
COMMISSION



ON SCIENCE,  
TECHNOLOGY,  
AND GOVERNMENT

# CONTENTS

INTRODUCTION .....	1
<b>PART I: OVERVIEW OF THE COMMISSION .....</b>	<b>3</b>
FOCI OF COMMISSION ATTENTION .....	3
<i>Strengthening Government Institutions</i> .....	3
<i>Understanding Common Functions</i> .....	4
<i>Dealing with Critical Issues</i> .....	5
STRATEGIES FOR SELECTING AND ADDRESSING PROGRAM AREAS .....	6
EMERGING THEMES .....	7
<i>The Science Adviser plays a broader and more important role</i> .....	7
<i>Improved analytic capability is needed</i> .....	8
<i>The government needs better S&amp;T personnel</i> .....	8
<i>Congress plays a crucial role</i> .....	9
<i>Economic performance is a driving S&amp;T policy issue</i> .....	9
<i>Coordinating S&amp;T activities continues to be difficult</i> .....	10
DISSEMINATION OF RESULTS .....	10
<b>PART II: PROGRAM ACTIVITIES .....</b>	<b>12</b>
EXECUTIVE OFFICE OF THE PRESIDENT .....	12
EXECUTIVE BRANCH ISSUES .....	14
<i>Environment and Energy</i> .....	14
<i>National Security</i> .....	15
<i>Economic Performance</i> .....	15
<i>Education</i> .....	16
<i>Environmental R&amp;D</i> .....	18
CONGRESS .....	19
JUDICIAL BRANCH & REGULATORY AGENCIES .....	21
<i>Judicial Program</i> .....	21
<i>Regulatory Program</i> .....	22
INTERNATIONAL .....	23
<i>Development Organizations</i> .....	23
<i>U.S. Government Organization for S&amp;T in International Affairs</i> .....	24
<i>Multilateral International Organizations</i> .....	25
STATES .....	27
SPECIAL CROSS-CUTTING ISSUES .....	28
<i>Personnel: Scientists and Engineers in the Federal Government</i> .....	28
<i>Nongovernmental Organizations</i> .....	29
<i>Long-term S&amp;T Goals and Priorities</i> .....	30
GENERAL ACTIVITIES .....	32
<i>Washington Seminar</i> .....	32

health  
space (big sum)

broader  
new thinking  
government  
with health

<i>Palo Alto Seminar</i> .....	32
<i>San Diego Seminar</i> .....	33
<i>Illinois Institute of Technology</i> .....	33
<i>American Association for the Advancement of Science</i> .....	34
<i>New York Academy of Sciences</i> .....	34
 <b>PART III: ADMINISTRATION</b> .....	 37
 <b>APPENDIX A: MEMBERS OF CARNEGIE COMMISSION ON SCIENCE, TECHNOLOGY, AND GOVERNMENT</b> .....	 A 1
 <b>APPENDIX B: MEMBERS OF THE ADVISORY COUNCIL, CARNEGIE COMMISSION ON SCIENCE, TECHNOLOGY, AND GOVERNMENT</b> .....	 B 1
 <b>APPENDIX C: ADMINISTRATION OF CARNEGIE COMMISSION ON SCIENCE, TECHNOLOGY, AND GOVERNMENT</b> .....	 C 1
 <b>APPENDIX D: TASK FORCES, CONSULTANTS, REPORTS AND PAPERS</b> .....	 D 1
EXECUTIVE OFFICE OF THE PRESIDENT .....	D 1
ENVIRONMENT AND ENERGY .....	D 2
NATIONAL SECURITY .....	D 3
ECONOMIC PERFORMANCE .....	D 4
EDUCATION .....	D 6
ENVIRONMENTAL R&D .....	D 8
CONGRESS .....	D 9
JUDICIAL AND REGULATORY DECISION MAKING .....	D 13
INTERNATIONAL .....	D 17
STATES .....	D 21
PERSONNEL .....	D 22
NONGOVERNMENTAL ORGANIZATIONS .....	D 23
LONG-TERM S&T GOALS AND PRIORITIES .....	D 25

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## INTRODUCTION

The Carnegie Commission on Science, Technology, and Government was established by Carnegie Corporation of New York in 1988. The Commission's charter was articulated by David Hamburg:

"We live in a world being transformed by science and technology. The pace of advance in basic scientific knowledge of the structure of matter and of life, of the nature of the universe, of the human environment — even of self-knowledge — has accelerated dramatically....The main purpose of the Commission is to seek ways in which the branches of government can encourage and use the contributions of the national scientific community. The nation needs more effective mechanisms, both governmental and nongovernmental, for analyzing thoroughly and objectively what science can do for society and how society can make sure that scientific and technological capabilities are humanely used."


Implicit in the charter is the concern that the decision-making processes of government are ill-equipped to handle both the opportunities presented by and the dangers posed by technological advances.<sup>2</sup> The Commission, an independent, bi-partisan body of experienced individuals, is unique in its focus on the organization and decision-making processes of government as they deal specifically with science and technology. It is expected to have a life of three to five years with some time spent on follow-up activities. Thus, we are now at the approximate midpoint of the Commission's existence. This progress report to the Corporation board reviews where we have been and where we are going.

Part I of this report provides an overview of the Commission. It describes its program activities in terms of *institutions*, *functions*, and *critical issues*. It describes our strategy for selecting and focusing our activities, some common underlying themes that have emerged from the studies so far, and our dissemination strategies.

Part II provides a comprehensive review of our current and planned activities, highlighting some of the issues and results.

Part III deals briefly with the Commission's administrative structure and finances.

Appendices A, B, and C list the Commissioners, members of the Commission's Advisory Council, and the staff and senior consultants. Appendix D lists members of and consultants to the ten Commission task



forces and the Committee on Science, Technology, and Congress, as well as all Commission reports and papers.

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## **PART I**

### **OVERVIEW OF THE COMMISSION**

#### **FOCI OF COMMISSION ATTENTION**

##### *Strengthening Government Institutions*

While the assumptions underlying the Commission's establishment are applicable to government at all levels, our priority has been the institutions of federal government — the Office of the President, the Executive Branch, Congress, and the Judiciary. The general question is how to improve the ability of these institutions and their constituent agencies to deal with issues involving science and technology. How should the president determine the feasibility of a space-based anti-missile system? How should a congressional committee decide whether and how soon to ban chlorofluorocarbons because of their effect on the ozone layer? How can the court system assess the alleged damage to thousands of Vietnam veterans from Agent Orange?

The Commission gave its first attention to the Executive Office of the President, looking particularly at the role of the President's science adviser. What standing and staff does the position need to be effective? How can the adviser get good information and advice in all relevant fields? Should the adviser have a role in coordinating the activities of the many government agencies involved in significant S&T issues such as global warming? The first report of the Commission, *Science & Technology and the President*, dealt with these and other organizational issues.

Even before the first report was distributed, the Commission initiated reviews of the impact of science and technology on Congress and the Judiciary. These institutions receive and process S&T information in very different ways: the courts rely on the adversarial information; Congress uses its staff, hearings, and constituencies. Both groups are made up primarily of non-scientists and both are often frustrated in their search for understanding of technological advances. As a result of the initial reviews, the Commission established a Task Force on Science and Technology in Judicial and Regulatory Decision Making and formed a Committee on Science, Technology, and Congress. These two major activities will extend through the life of the Commission.

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The Commission plans to establish a task force dealing with state governments. The states have always been crucial as producers of scientists, and many have recently established programs for support of science and technology and technology-based industries as a mechanism for economic development. States, particularly small states, may not have the resources to analyze their programs and deal with them effectively. Yet as "laboratories of democracy," their successful S&T activities can set a pattern that will be nationally followed.

### *Understanding Common Functions*

The S&T enterprise is so huge — the federal government alone spends \$60 billion supporting research and development activities — that it cannot be grasped whole. The Commission has found it useful in some cases to approach the problem by focusing on certain *functions* of S&T decision making that we have found to be common to all institutions:

- The first key function is information gathering and analysis.
- Once information is available, the second function is deciding on policies and priorities.
- Once policies have been established, agencies must implement them in a coordinated fashion.
- Finally, government needs the capacity to evaluate results to permit mid-course corrections and long-term judgments.

Several of the Commission's task forces are paying attention to one or another aspect of these functions. For example, with respect to information gathering (as David Hamburg put it in his charge to the Commission, "First get the facts straight!"): in the Executive branch, the Commission has initiated a task force to look at environmental R&D across all agencies; the Committee on Science, Technology and Congress is devoting two of its four study topics to information gathering and advice, one is on external sources and one is on the congressional support agencies; the Task Force on Science and Technology in Judicial and Regulatory Decision Making is commissioning

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numerous papers on how information can be made more readily available to judges within the traditional adversary system.

We have also identified certain problems that are common to all of these institutions' acquisition of information and advice — conflict-of-interest, quality of advice, conflicting perspectives, and the need to balance these in the decision making processes. We are optimistic that we will be able to distill recommendations that will be useful across agencies as well as within individual agencies.

### *Dealing with Critical Issues*

Finally, as the Commission's work developed, it became apparent that some institutions and organizational processes can best be examined and understood not in the abstract but in the context of a particular critical issue. For example, improving government coordination of activities of many agencies was explored by establishing a task force to examine the specific area of environment and energy.

In addition, some issues warranted examination directly. The Commission has established five task forces to consider key issues:

- How should defense technology adapt to recent changes in East-West relations?
- What is the government role in supporting commercial technology?
- How can the federal government use its resources to improve science education?
- How can we improve the use of S&T in international development?
- How can the government deal with the problems associated with environment and energy?

The Commission has also established two "cross-cutting" task forces. The first is looking at long-term priorities and goals for support of S&T by different agencies. It is asking how long-term and short-term goals can be



determined and balanced, and whether there should be an overall S&T budget where items are compared. Currently the budgets are looked at primarily in the context of individual agency programs. How should the Administration, for example, balance the support of so called "big science" — the Superconducting Supercollider or the human genome project — and "little science," the work of individual investigators?

The second cross-cutting task force is considering how to make more effective use of nongovernmental organizations (NGOs) as a source of S&T analysis and advice. NGOs such as the scientific societies already provide critical advisory functions, and could be even more effective. Other NGOs are powerful advocates on issues that have heavy S&T orientation, such as the environment.

The Commission has also entered into contracts with the National Research Council for a systematic review and analysis of the factors affecting recruitment, retention, and utilization of government technical personnel.

Finally, as the world becomes increasingly more integrated, most science and technology issues have major international implications. In addition to its Task Force on Development Organizations, the Commission is examining the way that the U.S. government can deal with global issues, such as the environment or the economy, that have important technical components.

#### STRATEGIES FOR SELECTING AND ADDRESSING PROGRAM AREAS

The options for Commission attention — institutions, functions, and issues — easily exceed the resources and time available. In trying to identify appropriate topics and to link them in a viable program, the Commission has picked targets of opportunity where:

- The topic is particularly significant;
- The Commission has a comparative advantage;
- The recommendations could have long-term impact;

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- A Commissioner or Advisory Council member is willing to take a lead role in the activity; and
  - There is serious receptivity to change.

In addressing its various topics the Commission has sponsored special studies, seminars, and workshops, and has contracted with scientific organizations and outside consultants. Its major activities, however, have been undertaken by its ten task forces and one special committee.

As the Commission activities continue, it is trying to pay attention to the missing pieces, the intersections that could bring together discrete studies, and the connections between separate activities that can be exploited.

#### EMERGING THEMES

During the Commission's first two years we have learned quite a bit about the deficiencies and strengths of the decision-making process and the content of the issues that will involve S&T in the future. Although each task force and study has generated many specific recommendations, six general themes have emerged from the work we have undertaken.

#### *The Science Adviser plays a broader and more important role*

With the prominence of science and technology as factors affecting issues of national concern such as economic performance, the environment, and space technology, the role of the President's Science Adviser has assumed renewed significance. Dr. Allan Bromley has been Assistant to the President for Science and Technology for a little over a year and is playing a far more important role than did his recent predecessors. The President's Council of Advisers on Science and Technology (PCAST) is very active under his leadership. Dr. Bromley has established a number of panels of the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET), and the Cabinet members are attending its meetings.

The government is paying attention to Dr. Bromley and his Office of Science and Technology Policy. It is natural, therefore, that almost every

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Commission task force that has dealt with issues involving the Executive Branch has called for giving more responsibility to the Science Adviser. The Commission will have to consider the totality of its recommendations for the office, and whether there are organizational answers to the emergent problems of success.

*Improved analytic capability is needed*

As discussed above, the need for improved analytic capability permeates all the branches of government and many of the issues the Commission is addressing. A major consultant report by William Wells described the need for both policy research and policy analysis within the Science Adviser's office. Members of Congress and their staffs have great difficulty in sifting through S&T information they receive to get the facts and in obtaining high quality and timely analysis.

A major problem facing the judiciary subgroup of the Task Force on Science and Technology in Judicial and Regulatory Decision Making is improving the quality and availability of S&T information in judicial decision making. This information must be obtained in the context of an adversarial process where the parties are intent on promoting their own interests. The same need has come up in the report of the Task Force on Environment and Energy, and in the discussions of the Task Force on Science, Technology, and Economic Performance .

The Commission may do some further work to see whether there are more general solutions to the problem that are not agency-specific.

*The government needs better S&T personnel*

The task force reports and studies show a persistent concern with the quality of government S&T personnel, and, in particular, the difficulty of recruiting high-level and mid-level S&T decision makers and managers. The Task Force on National Security, for example, worried about the Department of Defense Laboratories.

Although a less-than-competitive pay scale is probably the most important problem, other issues such as conflict-of-interest rules, inflexible management, and inadequate opportunities to advance professionally are also important. A further dilemma is the position of government personnel people

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who do not want to give special treatment to a particular group, such as scientists, for fear that other groups will immediately demand parity.

*Congress plays a crucial role*

In 1960-1968, the same party held the Presidency and the Congress, and for half of that period, the President was a master manipulator of the Congress. The Executive had the information sources and took the initiative where S&T was concerned. Congress made only minor modifications.

That era ended with the establishment of the Office of Technology Assessment, the Science Policy Research Division in the Congressional Research Service, and the vast increase in Congressional staff size. Indeed, over the last two decades Congress has dominated some areas of science policy, including environmental and health policy. In the areas of air and water pollution and hazardous waste cleanup, Congress has set the environmental agenda, enacting more than a dozen major laws since 1970.

Several of the Commission's task forces have expressed concern about the diffusion of Congressional responsibility in different committees. The Commission's Committee on Congress has been asked to work on this problem to see what root causes of conflict between committees exist, as well as what options are available for dealing with them.

*Economic performance is a driving S&T policy issue*

Military security was the issue that led to the recommendation by William Golden to President Truman in 1950 to appoint a science adviser to the president. After Sputnik, it was military security, again, that prompted President Eisenhower to bring the Science Adviser into the White House. It has been the major reason for government involvement with S&T for 45 years. Military outlays have commanded the bulk of the funds and much of the attention over this time period, despite the growth of health and non-military space activities.

We are now entering a new era. The primary justification for involvement of government in science and technology has become its contribution to the overall economy in broadest terms, including its role in education and health. The national security report calls for a strong technology base for defense purposes, but it also calls for bringing the

commercial and the defense sectors closer to each other. The Task Force on Economic Performance is seeking a consensus on the role for the government in commercial technology. While there is growing concern about technical leadership in the U.S., particularly compared with Japan and Germany, we are not yet ready to substitute economic warfare for military warfare. Leaders in U.S. technology-based industries believe that governments in Europe and Japan support technology-based industry more directly and more easily than does our federal government, and that this will damage our economy in the long run.

*Coordinating S&T activities continues to be difficult*

The Executive Office of the President has major oversight responsibility in the Executive Branch. The chief mechanisms for coordination are the budget process, the cabinet councils and, in the S&T area, the Federal Coordinating Council on Science, Engineering, and Technology. Can these mechanisms be made more effective?

Congress is looking for ways to address cross-cutting problems. The Committee on S&T and Congress suggests that Congress consider establishing an S&T Study Conference to bring members of both Houses together to try to find ways of working on complex S&T issues that cut across numerous committees. Coordination among the regulatory agencies also needs improving. Can they develop uniform regulatory priorities according to the risk involved?

Beyond coordination, there is a growing need for program and policy integration and synthesis in areas involving S&T that exceed the present institutional capabilities in either the Executive Office or the Congress.

## DISSEMINATION OF RESULTS

While the Commission activities are independent of government, Commission staff and task force members are in close touch with government officials who are involved with science and technology. For example, the Committee on Congress meets regularly with interested members of the House and Senate, and gets their reaction to ideas during their studies. The

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task force dealing with judicial issues has been in close communication with the Federal Courts Study Committee. The implications of Commission recommendations have been reviewed with executive branch officials as a means of ensuring their early consideration.

Three Commission reports have been issued. They have dealt with the organization of the Office of the President, ways for improving top-level decision making on the interacting areas of environment, energy and the economy, and defense technology. Press releases describing the reports have been issued and copies have been made available to interested individuals and groups.

In addition, the National Research Council has released a Commission-sponsored report on recruitment, retention and utilization of scientists and engineers by the federal government. Also, early in the Commission's work, the Federal Courts Study Committee reprinted a report prepared by a working group of the Commission in the judicial area.

In addition to dissemination of its reports, the American Association for the Advancement of Science has asked the Commission to present its work to the S&T community. Staff and members have given lectures on Commission activity. Seminars on issues of Commission interest have been held in a number of cities. These seminars have been chaired by Commissioners.

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## **PART II**

### **PROGRAM ACTIVITIES**

#### **EXECUTIVE OFFICE OF THE PRESIDENT**

In recent years, there has been a substantial increase in the number and scope of issues coming before the President whose resolution require S&T knowledge and informed professional judgment. They stem from the acceleration of scientific knowledge, from opportunities these developments offer, and from an increased understanding and awareness of their economic and societal consequences. Among the critical S&T issues facing the President are those related to: national security policies with their interwoven technical, political and military dimensions; the directions and funding of future space efforts; commercial technology and economic performance; scientific research related to health care; the scientific and technological underpinnings of environmental quality; priorities for basic research and large-scale S&T programs; and policies to strengthen S&T education and research. In our studies of the Presidency, the Carnegie Commission's efforts have concentrated on how the President can obtain the best S&T advice available for policy development and for the oversight and coordination of the R&D efforts of the federal departments and agencies.

In October of 1988, the Commission issued its first report, *Science & Technology and the President*. Its principal recommendation was to upgrade the position of the science adviser to that of Assistant to the President who would continue to direct the Office of Science and Technology Policy in the Executive Office of the President (OSTP). It also recommended the creation of an advisory committee of outside scientists and engineers. The report emphasized the need for strong relationships between the Assistant to the President for S&T and the principal offices and councils within the Executive Office. The Commission's report was delivered to the President-Elect in November 1988. In his budget message, the President announced his intention to appoint an Assistant for S&T and to establish the President's Council of Advisers on Science and Technology (PCAST).

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Recognizing the need to deepen the analytical capabilities of the Executive Office for the performance of S&T policy and program functions, the Commission supported a study of the policy and analysis role of the OSTP. While it did not support suggestions for establishing an external, dedicated policy analysis and research unit linked to the OSTP, the study did call for strengthening existing arrangements, with a strong focus on internal Executive Office capabilities for integrated analysis.

Another consultant report for the Commission describes and discusses the federal budget process as it affects budgets for R&D. It points out the difficulties of defining priorities and "balance" in the budget, since R&D budgets are normally reviewed and balanced as part of the missions of specific agencies. Nevertheless, it recommends mechanisms for better analysis of the implications of R&D budgets.

The roles and functioning of scientific and technical advice in the government were treated in a Commission study of the S&T advisory system of six agencies. It addressed the issues of: assuring "representative" membership; the question of narrowness of focus on technical issues; conflict-of-interest requirements; the independence of S&T advice; and requirements for staff support. A separate consultant paper on conflict-of-interest legislation and its interpretation by Executive Orders was used by the Assistant to the President for S&T in briefing incoming members of PCAST.

An informal meeting of advisers to heads of states is planned in February, 1991. This will include the science advisers of the summit countries, the USSR, and the European Commission. Dr. Allan Bromley and Dr. Yuriy Ossipyan (USSR) have agreed to serve as co-chairs.

The Commission will host a dinner meeting of the President's Council of Advisers on Science and Technology (PCAST) to discuss the work of the Commission.

The policy analysis and research capability of the White House and Executive Office as a whole will be a subject for study in 1992 from the standpoint of the integration of S&T in the overall Presidential decision-making structure and process. The Commission's reports on S&T and the President, OSTP analytical capabilities, E<sup>3</sup>, and economic performance all point to the need for integrated analysis in developing policy options.

Also planned in 1992 is a case study of a priority program area that would examine the role, capabilities, and procedures of the Federal Coordinating Council for Science, Engineering, and Technology and its coupling with the decision-making process.



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## EXECUTIVE BRANCH ISSUES

### *Environment and Energy*

Environmental issues that face the government are extraordinarily complex. They involve short-term issues, such as oil spills and cleaner air; medium-term issues such as the impact of acid rain on forests and lakes; and long-term issues such as radioactive waste disposal and global climate change. The Commission established a task force in the spring of 1989 to examine how the executive branch of the U.S. government might be strengthened to deal with problems in this area.

The task force quickly concluded that environmental issues could not be considered without an understanding of energy needs, and that these two, in turn, cannot be managed without an understanding of the economic implications of policy options. It looked at top-level coordination of research, monitoring and assessment, and policy formulation and implementation.

The report of the Task Force on Environment and Energy was submitted to the Commission at its November 1989 meeting. Entitled *E<sup>3</sup>: Organizing for Environment, Energy, and Economy in the Executive Branch of the U.S. Government*, it was published in April 1990.

The report called for greater emphasis on developing and structuring incentives to prevent environmental problems, not just to respond to problems after they occur. The Executive Branch also needs to cope with the multitude and subtlety of interfaces between issues, not only of environment and energy, but of the economy as well. The E<sup>3</sup> report says a strong U.S. institutional base in the areas of environment and energy is a vital, though only a partial, basis for addressing what are in large part global problems. It also suggests there is an abundance of organizations dealing with specifics, but not their integration, and it explores some alternatives for improving the situation.

The report has stimulated broader discussion within the Executive Branch and the interested public about how the institutions of the U.S. government can best be adapted in coming years to face a daunting array of challenges related to environment and energy. Some 4000 copies of *E<sup>3</sup>* are now in circulation. The report is being widely cited, by officials from the Departments of Energy and State, EPA, and other agencies, and by leaders in the environmental field from industry, universities, and nongovernmental organizations. There have numerous requests to task force members and staff to speak about the report. Although the report's specific recommendations

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have yet to be implemented, the point of view that the task force developed is gaining broad support, which bodes well for the long run. Results to date may be best summarized by saying that the term "E<sup>3</sup>" seems to be entering the policy lexicon.

### *National Security*

The *ad hoc* Task Force on National Security was set up by the Commission in 1990 to make recommendations on how the U.S. national security establishment can adapt to political, economic, and technological changes: the decreased threat of the Soviet Union and Eastern Europe, the increased threat of regional and local conflicts, the decline in American dominance in technology, and the difficulty of the Department of Defense in selecting, procuring, and managing technology. The recommendations of the task force report, *New Thinking and American Defense Technology*, include creating a national security S&T advisory panel under the combined auspices of the national security and science advisers, strengthening the Defense Science Board and the defense technology base, and broadening the charter of the Defense Advanced Research Projects Agency to facilitate the transfer of defense technologies whenever they have important commercial applications.

Drs. Ashton B. Carter and William J. Perry prepared the report for the task force. They have discussed the report and its findings with senior members of the administration and Congress. 1750 copies of the report were mailed initially and the remaining 500 copies from the first printing were gone within two weeks. A second printing of 2400 copies was necessary to meet outside requests.

### *Economic Performance*

In response to the global competitive challenges facing U.S. industry, the Commission created the Task Force on Science, Technology, and Economic Performance in May, 1989. Although the major responsibility for advancing commercial technology rests with the private sector, government institutions also contribute to this goal. As a major consumer of the products of science and technology, government must also insure that its own needs are

met. Since many private and public groups have examined the importance of macroeconomic policies for technological innovation and diffusion, the task force decided to focus more narrowly on improving the internal governmental organization and decision-making process for advancing and diffusing technology.

The task force is looking at two specific areas. First, how can decisions about the appropriate government policies and programs for advancing technology be made consistent? Various aspects of this issue involve different organizations in the Executive Office — policy councils such as the National Security Council, the Domestic Policy Council, the Economic Policy Council and the Competitiveness Council, and agencies such as the Office of Science and Technology Policy, the Council of Economic Advisers, and the Office of Management and Budget.

Second, how should the government develop and implement policies for supporting technology directly? What should be the role of the Defense Advanced Research Projects Agency which has been a major supporter of defense technology that has later entered the commercial sector? What is the role of the Department of Commerce? How should the government implement its position that it should support generic, precompetitive technology?

The task force will consider a draft of its report at its meeting on October 30, 1990.

### *Education*

The Commission has established a new Task Force on K-12 Science and Mathematics Education whose charter, in part, reads:

"The President and the nation's governors have agreed that the United States should significantly and relatively rapidly improve its elementary and secondary mathematics and science education by the year 2000. The task force will consider the federal role in pursuing this goal. It will seek to define federal responsibilities for policy making and program execution that are feasible, effective, and politically acceptable. It will focus on the two key agencies that have primary responsibility in this area, the National Science Foundation (NSF) and the Department of Education (DoEd). These agencies' roles and responsibilities will be examined in the context of significant support and complementary

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programs by other federal agencies, particularly the Department of Health and Human Services and its National Institutes of Health (NIH), the Departments of Defense (DoD) and Energy (DoE), and the National Aeronautics and Space Administration (NASA)...

The goal established by the President and the governors includes two objectives: giving sound mathematics and science education to all elementary and secondary students and assuring that a larger number of talented students become scientists and engineers. Both of these objectives require special attention to improving access and performance by women and minorities."

Questions that the task force will deal with include:

- 1) How can the NSF and the National Science Board determine the balance between the need for support of current high quality scientific research, and the need to build the nation's future scientific base through support of science and mathematics education?
- 2) What are the appropriate roles, responsibilities, and capabilities of the Department of Education as they relate to mathematics and science education?
- 3) How should decisions be made in the Executive Office of the President? What are the special responsibilities of the Office of Science and Technology Policy, the Federal Coordinating Council for Science, Engineering and Technology, the Office of Management and Budget, and the Domestic Policy Council?
- 4) Other federal departments and agencies (NIH, DoD, DoE, and NASA) are major producers and consumers of scientists and scientific research. They contribute to the training of and manage or support institutions that employ a large fraction of the nation's scientists, mathematicians, and engineers. How can their staffs, and those of the laboratories they manage, provide significant support to the work of NSF and DoEd?

The task force is staffed by Dr. Rollin B. Johnson who will be based at Harvard University with Dr. Lewis M. Branscomb, the task force chair. It will meet during the academic year 1990-91 and hopes to have its report ready by the end of 1991.

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## *Environmental R&D*

Environmental research is conducted throughout the federal government by a wide range of departments, agencies, and offices. These include the Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration, the National Science Foundation, and the Departments of Interior, Energy, Agriculture, Health, and Defense, among others. More than two billion dollars in fiscal year 1990 was devoted to supporting environmental science research, in addition to money spent in other fields of research which indirectly relate to the quality of the environment.

Recent legislation in Congress proposes a number of initiatives which impact the organization of environmental research. The elevation of EPA to cabinet status, including the formation of a new Bureau of Environmental Statistics, could result in additional research responsibilities for the new Department. A National Institutes of the Environment has been proposed to serve as a national focal point for ecological research not only for EPA but also for other federal agencies, states, universities, and the private sector. Most recently, a proposal has been made to establish a Strategic Environmental Research Program to utilize the resources of the Department of Defense for environment-related research.

In response to these issues, the Commission has established the Task Force on the Organization of Federal Environmental R&D Programs. The task force plans to examine the fundamental structure and organization of federal environmental R&D programs, as well as their relation to the new initiatives. What are the strengths and weaknesses of the current organization of research? How well do the various agencies coordinate and cooperate in their research endeavors? Should environmental research be decentralized among many specialized laboratories and programs, or would concentration of research in an Environmental Research Institute be more appropriate? How much of the federal environmental research effort should be organized under a Department of the Environment? Are adequate resources being devoted to environmental R&D?

A final report is scheduled to be released in early 1992.

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## CONGRESS

The United States Congress is increasingly faced with complex decisions about a range of policy issues related to science and technology. The Commission's Committee on Science, Technology, and Congress is chaired by Commissioner John Brademas, a Member of Congress for 22 years.

The Committee is advised by a bipartisan Congressional Advisory Council of more than forty Senators and Representatives. Council meetings to date have focused on a range of topics including the value of different sources of S&T analysis and advice, ways to expand the Congressional Science and Engineering Fellows Program, the challenge of setting major S&T priorities through the budget process, and other issues of concern to both Commissioners and Members of Congress.

In addition, the Committee holds regular meetings with congressional staff, staff of the congressional support agencies and other experts, including scholars of Congress, in order to build consensus and constituencies that will support approaches to enhancing ways that Congress addresses science and technology issues. A number of background papers have also been commissioned to aid in the analysis of issues related to these topics.

The Committee held its first meeting with the Congressional Advisory Council in March, 1990, preceded by formal and informal discussions with congressional staff. The second Advisory Council meeting was held in July, 1990.

The Committee on Congress is currently completing work on its first study topic which examines the interactions between Congress and the scientific and engineering communities in academia and industry as well as the use of scientific and technical information from these groups in the policy-making process. The report, *Expert Advice and the Decision-Making Process*, will be released in November, 1990.

The Committee's second topic is devoted to S&T-related analyses and advice generated by the four congressional support agencies: the Office of Technology Assessment, the Congressional Research Service, the Congressional Budget Office and the General Accounting Office. This report will be completed in mid-1991.

Work on the third topic centers on the appropriation, authorization, and oversight of federal S&T programs. Included in this study will be the processes by which cross-cutting S&T issues are addressed and major budget

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priorities are established. The Committee will complete its work by looking at longer range issues, including the role of the media in informing the public on S&T matters and understanding the changing public context in which Congress will make decisions related to S&T issues. The reports on both of these topics will be issued in 1992.

The Committee is taking a consultative and constituency-building approach to its work with Congress — trying to build support for implementation of its recommendations at the same time it is formulating them. Meetings held by the Committee have been well-attended and the Committee has already built significant interest for its work on Capitol Hill.

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## JUDICIAL BRANCH & REGULATORY AGENCIES

Recognizing that the legal system and governmental processes are increasingly confronted with complex S&T issues, the Commission established the Task Force on Science and Technology in Judicial and Regulatory Decision Making in 1989. The task force meets twice a year, with subgroups focusing on specific issues meeting more frequently.

### *Judicial Program*

In its judiciary program, the task force seeks to enhance the quality of S&T information available to the courts and their ability to manage and adjudicate cases involving S&T issues, especially complex ones such as mass toxic torts and environmental issues. The judicial program is designed, in part, to aid the Judicial Branch's long-range plan to conduct a comprehensive examination of how courts handle scientific and technological complexity in litigation. This element of the plan was adopted by the Judiciary following recommendations by the Commission. Judge Jack B. Weinstein leads one subgroup which is exploring ways of enhancing judicial S&T capabilities through improved case management techniques, including the effective use of court-appointed experts. Particular emphasis is being placed on the interface of discovery and evidentiary rules as they affect the courts' ability to obtain and apply S&T information within the traditional adversarial process.

Among other initiatives of the task force, procedures will be developed to enhance and encourage the fairness and accuracy of judicial notice of S&T literature. A series of brief science papers on substantive social and natural science areas (causation, toxicology, epidemiology, statistics) is being prepared to provide an insight into terminology, concepts, and uncertainties within and among disciplines. A grant has been made to the ABA/AAAS National Conference of Lawyers and Scientists to engage the outside S&T community in devising ways to facilitate the identification of court-appointed experts and the assessment of S&T materials at the request of judges.



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### *Regulatory Program*

In its regulatory program, the task force endeavors to promote better decision making by participants in science-based regulation, focusing in particular on the Environmental Protection Agency, the Food and Drug Administration, the Consumer Product Safety Commission, and the Occupational Safety and Health Administration (the "health and safety agencies" — EPA, FDA, OSHA, and CPSC). These agencies are, relative to the courts, sophisticated in using science to inform their decisions. However, seemingly small inefficiencies in agency performance can cost the public dearly, in both dollars and lives.

The task force is examining several problem areas. Among these:

- 1) There is much inconsistency within and between agencies in risk assessment and management.
- 2) Agencies frequently do not effectively communicate the nature of hazards they regulate to the public, nor learn the public's perceptions of those hazards.
- 3) Government policies and procedures inhibit the ability of agencies to attract top scientists to serve on advisory boards, and to screen or compensate well for biases these scientists might have.
- 4) Agency science bases are developed with an overly short time horizon, leading to a lag in preparedness for new scientific challenges.
- 5) In some instances, current legal and administrative requirements unduly restrict the flexibility of science-based policy making by agencies.

Experts in each field will prepare working papers to aid the task force in its investigation of the above-cited problems. During its deliberations the task force will invite comment from the regulatory community, and address (to the degree possible) that community's opinions and analytical needs.

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## INTERNATIONAL

The Commission's activities concerning S&T in international affairs emphasize three major areas. The first is the use of science and technology in the development of the less economically advanced nations of the world. The second focuses on how the United States is organized within its own government for improving the application of science and technology in international affairs. The third set of activities addresses how nations work together multilaterally on matters of common interest involving science and technology, like global environmental change. An International Steering Group oversees these activities.

### *Development Organizations*

The Commission's largest international activity is the Task Force on Science and Technology for Development which was established in January of 1990. The task force is addressing such questions as: How can the scientific and technical capabilities of aid organizations, e.g., the U.S. Agency for International Development, be strengthened? How can the organizational base for long-range, strategic thinking about science, technology, and development be improved in both developing countries and the United States? How do aid organizations fit into the overall strategy for global development?

At a workshop at the Carter Presidential Center, it became clear that there is a perception that many governmental and intergovernmental development programs are declining in effectiveness, both absolutely and in relation to the enormous gap between rich and poor, and the demands of rapidly expanding populations. The system of foreign assistance, as it relates to science and technology, needs to respond to new conditions, to evaluate its performance more effectively, and to develop strategies that are more collaborative and more consistent with the lessons learned over the past 30 years. There is a corresponding requirement to design a more effective network of institutions to mobilize and utilize scientific and technical knowledge that is currently largely external to the less developed countries. Both the Legislative and Executive branches have urged comprehensive reappraisals.

The goals of the task force include:

- 1) delineation of goals and alternatives for development programs, at various levels of resources;
- 2) evaluation of current institutional machinery and decision-making processes, giving special attention to mechanisms for continuing evaluations to obtain effective feedback to learn how best to create means for improvement of existing and planned programs;
- 3) exploration of the total range of institutions that ought to exist for the future, emphasizing realistic ways either to repair and revivify existing institutions or build new ones;
- 4) recommendation of a process of experimentation to tap the entrepreneurial and creative energy of aid donors, the for-profit and non-profit participants in the process, and the people in nations whose goals and needs are to be served.

The task force, which is focusing upon the health area for analysis and illustration, will collect and analyze information, sponsor relevant studies, and deliver its recommendations to the Commission at the end of 1991. During 1992 the task force and the Commission will work toward the implementation of the agreed-upon goals.

#### *U.S. Government Organization for S&T in International Affairs*

The Commission and the Council on Foreign Relations convened a workshop, "Organization and Resources of the U.S. Government for S&T in International Affairs," attended by 65 people in June 1990.

The international purposes and programs of the United States government increasingly demand an integration of scientific and technological insights into policies for trade, defense, health, agriculture, space, and other critical sectors of the nation's goals. By tradition, practice, and law, the State Department has primary responsibility for this enormous domain. The State Department has not had the resources to fulfill its responsibility, and no other administrative arrangement has emerged over the years to provide the needed leadership. As a result, U.S. international relations suffer. The government does not tap available technical resources for planning and action within a

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coherent organization. In light of this assessment, recommendations are likely to comment on needs to:

- Continue to strengthen and extend the role of OSTP in the White House councils governing international affairs.
- Consider the appointment of a top-level science adviser to the Secretary of State.
- Consolidate and restructure the increasing, multiple technical staffs in foreign posts (including, e.g., Defense, CIA, Commerce, Agriculture, NSF, AID) recognizing the primary roles of the ambassadors in orchestrating work in each country and of the State Department in Washington for policy making.
- Chart more effective reporting to the Congress, as mandated by law, with an emphasis on evaluation of trends and analysis of priorities.
- Increase the external research and consulting resources available to State for examining facets of S&T in international relations.

A group led by Rodney W. Nichols is now preparing a report based on the June workshop and other inputs. A draft is expected to be available in January 1991 and a final publication is due in the spring of 1991. The Commission will undertake a sustained effort to implement key recommendations that emerge from the report through a series of dissemination events in the spring.

### *Multilateral International Organizations*

The third activity is directed at international organizations. Major challenges facing the United States, like global environmental change, can only be addressed effectively by joint international programs of research, assessment, and response. For such challenges, international organization and decision-making must become more effective to increase benefits from, and

diminish problems presented by, science and technology. As one stream of its international activities, the Carnegie Commission is exploring science and technology in international organizations, and the associated needs and opportunities from a U.S. perspective.

During 1990, the Commission carried out a case study, centered on a workshop in June, on scientific dimensions of international organizations and decision-making concerned with problems of the global environment such as ozone depletion, climate change, acidification, and biodiversity. A letter summarizing selected recommendations of the case study was sent to the White House Assistant to the President for Science and Technology. A report is being drafted by a group led by Thomas F. Malone and Jesse H. Ausubel based on the workshop and other inputs. The report will be available in January 1991, and a final publication, *International Environmental Institutions: A 20-Year Prospect*, is due in the spring of 1991. Another aspect of the effort is an examination of the U.S. government role in international scientific cooperation as viewed by our cooperating partners. This report will be available in December 1990.

In 1991-1992, the effort may be extended with a workshop on international human resource flows.

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## STATES

State government decision makers face many weighty challenges that can be met only with scientific and technological (S&T) analysis and advice of the highest quality:

- The states have primary responsibility for educating young Americans, and future availability of competent scientists and engineers is determined in large part by pre-college S&T educational opportunities. Hence, state government decisions about how and how much to teach pre-college students about science significantly influences America's capacity to conduct scientific research and development (R&D).
- State government can, through strategic investment in R&D infrastructure, dramatically foster technological innovation and transfer by private firms. America's ability to restore its competitive position in the world marketplace depends critically on its ability to innovate and transfer advances to consumers. State government investment decisions, therefore, may substantially affect the nation's economic performance.
- And the states may, if they choose, enact more stringent and more imaginative environmental laws to control untoward effects of technology than the federal government.

However, despite the importance of science and technology in state governance, it appears that many states are not organized well to obtain, assess, and utilize scientific and technological information. In recognition of this, the Commission will form a Task Force on Science and Technology and the States to be chaired by (outgoing) Governor Richard Celeste of Ohio.

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## SPECIAL CROSS-CUTTING ISSUES

### *Personnel: Scientists and Engineers in the Federal Government*

Problems faced by agencies of the U.S. government in the recruitment and retention of scientists and engineers have been documented over the past decade and are generally well known. The problems relate both to the "hollowing out" of technical agencies through shortcomings in staffing of career employees, and to difficulties in attracting outstanding high-level non-career appointees with technical backgrounds. Factors underlying the problems include inadequate federal pay and recruiting efforts; inflexibility of the civil service system; poor working environments; weak leadership; and stringent conflict-of-interest and disclosure guidelines.

The Commission is sponsoring studies both to summarize and evaluate the present situation regarding the government's ability to attract and retain technical personnel, with specific focus on the pertinent organizational and decision-making processes. Phase I of the studies consisted of a review by the Office of Science and Engineering Personnel (OSEP) of the National Research Council of the National Academies of Sciences and Engineering by assembling existing information of the issues involved.

The Phase I effort was organized by a committee chaired by Alan K. Campbell, former director of the OPM and the report is now available. Phase II of the project has been initiated to make recommendations, rather than simply collect information and define alternatives. Phase II is being carried out by two panels, one following up on findings about the technical agencies as a result of issues relating to career civil servants, and the second on issues relating to political appointees.

In coordination with these efforts, the Commission is sponsoring a study by the Council for Excellence in Government (CEG). The product of this effort will be a book, *The Science Sixty: The 60 Toughest Scientific and Technical Jobs in Washington*, ("Prune Book II") to be published in September, 1991. Like the first Prune Book, published by CEG in 1988, the S&T volume will depict each position in terms of its responsibilities, problems, environment, challenges and the type of training and experience needed.

The NRC study has identified several findings with regard to the recruitment, retention, and utilization of federal scientists and engineers. First, the availability and relevance of data on the federal science and engineering workforce are seriously limited. Second, management practices

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relating to the career workforce such as length of time required to extend an offer of employment remain serious impediments to an improved workforce, even though mechanisms to address the barriers have been identified. Third, there is evidence to support the growing concern about the adequacy of the political appointments process and the impact of political appointees on the fulfillment of federal responsibilities in science and technology.

The Commission's explorations in this area have already resulted in fresh consideration of issues relating to the quality of science and engineering personnel by the Office of Personnel Management and the Merit Systems Protection Board as well as by more than ten federal agencies. The efforts of the Commission to keep this issue before the public and the Congress have also been recognized by the White House Office of Science and Technology Policy. To bring about progress in this area will require a broad coalition of concerned groups, and the foundation appears to have been laid successfully during the past year for joint effort involving the National Commission on the Public Service and its successors, the National Academies of Sciences and Engineering, and other groups.

### *Nongovernmental Organizations*

Because of the growing importance of science and technology nongovernmental organizations (NGOs), the Commission has established the Task Force on Nongovernmental Organizations to undertake an examination of these organizations with respect to improved use of scientific and technological information in governance.

Many science and engineering NGOs are organized along disciplinary lines; others cut across disciplinary lines. Many provide a platform for scientists and engineers to convey their ideas and findings to public forums; some seek to accomplish this through informal discourse with policy makers while others employ advocacy approaches on such issues as education, training, and budgetary priorities.

The task force will address the following issues:

- 1) What more can the federal and state governments, in their need to obtain objective information and analyses on issues involving S&T, do to use the talents and expertise embodied by NGOs?
- 2) What is the role of NGOs in stimulating policy innovation?



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- 3) What avenues do NGOs open up by providing studies that government does not have the time nor the inclination to do?

Several general perceptions have already emerged. It is clear that NGOs are an important and growing element of the pluralistic and democratic U.S. institutional scene. The growth of NGOs has added a fourth dimension to the traditional model of government-industry-university relations. NGOs have demonstrated efficacy in several areas, including provision of analytic capacities to government, through developing professional consensus and authoritative reports, and through assisting in dispute resolution. NGOs may be an important new route for overcoming policy gridlock.

The Commission's task force is the first effort ever of which we are aware to undertake a systematic examination of NGOs in science and technology. The task force has met several times and will summarize its work with a final report to the Commission in the summer of 1991. In the fall of 1991, a large public forum will be held to discuss the findings of the report.

Approximately a dozen S&T NGOs have already been directly involved in the studies of the task force. There are indications that the consultations of the task force are already proving helpful to these organizations through the identification of issues and questions critical to their future.

### *Long-term S&T Goals and Priorities*

Due to the decentralized nature of federal S&T programs, establishing major goals and prioritizing them relative to each other is a particular challenge. How can the nation go about setting long-term goals? Through what mechanism can leaders in industry, academia, and government be brought together to discuss and debate long-term goals? In recent years, a number of organizations have examined various issues with respect to S&T budgeting and priority-setting, but little work has focused specifically on the long-term aspects of these processes.

The Commission has established a new Task Force on Long-term S&T Goals and Priorities which had its first meeting on October 12. The goals of the task force are to propose specific approaches to establishing long-term national goals and priorities, to describe the pitfalls in priority-setting efforts, and to suggest ways to avoid them.

This effort will bring together various aspects of Commission work related to both the executive and legislative branches of government. For

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examples, the Committee on Science, Technology, and Congress (of which Commissioner Stever is a member) is examining budget issues under its third study topic area which includes appropriation of S&T programs, and Willis Shapley wrote a report on the federal budget process (*The Budget Process and R&D*) with primary focus on the executive branch.

A total of approximately four task force meetings will be held in fiscal year 1991. In the spring of 1991 a workshop will be convened to allow individuals with varied perspectives on the S&T budget/priorities area to discuss and debate some of the early ideas developed by the task force. A draft of the final report is scheduled to be delivered to the Commission for review in October of 1991 with a target date for release set in February 1992.

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## GENERAL ACTIVITIES

The Commission supports various *ad hoc* activities to complement its topic-focused program activities.

### *Washington Seminar*

Commissioner H. Guyford Stever chaired a seminar in the Washington D.C. area to examine two issues: overall government coordination and setting S&T budget priorities.

In analyzing coordination issues, the members of the seminar recommended that coordination be considered in the context of a particular issue. Accordingly, the Task Force on Environment and Energy was formed to look at that area. The discussions in the seminar on budgets and priorities led to the establishment of the Task Force on Long-term S&T Goals and Priorities. Both task forces are chaired by Dr. Stever.

### *Palo Alto Seminar*

The Commission sponsored a seminar in Palo Alto from 1988 to 1990. The seminar was co-directed by the three Commission members from the area, Donald Kennedy, Sidney D. Drell, and William J. Perry, and was staffed by David Bernstein.

The seminar brought together interested people from the Palo Alto area to review some of the issues that could become the subject of task force discussions. The issues discussed included:

- 1) the role of science and technology in economic performance;
- 2) the changing role of technology in national security issues;
- 3) improving the way that regulation deals with advances in science and technology;
- 4) the changing role of universities in exploiting technological advances;
- 5) provision of health care;
- 6) the implications of a nationwide communications network on the improvement of health care.

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The information from the first three issues has been used by the task forces dealing with these subjects.

### *San Diego Seminar*

Commissioner Richard Atkinson sponsored two meetings, one in 1988-89 and one in 1989-90 at the University of California, San Diego which brought together natural scientists from the area with political scientists and economists to discuss their different ways of looking at policy for science. Dr. Atkinson was aided by William Blanpied, then on leave from the National Science Foundation.

Discussions at the meetings focused on the relative lack of focus on Congress rather than the Executive by most scientists. The importance of the Congressional role in the budget process, and particularly the role it has taken in recent years as a result of the national fiscal problems, has been decried rather than exploited according to the political scientists. The natural scientists — particularly those who had been involved with national security policy — said that, in their view, the executive role had been predominant.

Reviews of the transcripts of the meeting have been prepared by Dr. Matt McCubbins of the Political Science Department and Dean Peter Gourevitch, University of California, San Diego.

### *Illinois Institute of Technology*

As part of the celebration of its centennial, the Illinois Institute of Technology invited key leaders and policy makers from industry, government, and academia to participate in a one-day conference to examine the following questions:

- 1) How can we develop better resource allocation strategies to resolve competing economic and social concerns?
- 2) Can we find low-cost trade-offs between the world's rising demand for energy and the growing threat of environmental degradation?
- 3) What is the role of education — the cultivation of our human resources — in the context of these issues?

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- 4) What can be the unique contribution of science and technology in framing the answers to these questions?

The Commission is supporting the preparation of a summary of the conference by Victor MacIlhenny of Massachusetts Institute of Technology, a well known science writer, and distribution of his report by the University.

*American Association for the Advancement of Science*

The Commission will sponsor a two-session symposium at the February 1991 annual meeting of the AAAS in Washington, DC. The symposium is entitled "Organization for S&T in the Executive, Legislature, and Judiciary." The morning session will be chaired by William T. Golden and the afternoon session will be chaired by David Z. Robinson. Speakers and the titles of their talks are:

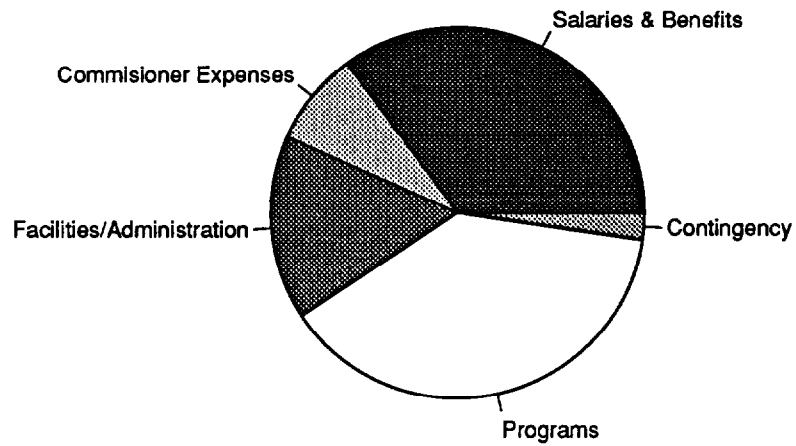
- "The Role of the President's Council of Science and Technology Advisers in Presidential Decision Making", David Z. Beckler
- "Confronting a World Transformed: The Carnegie Commission on Science, Technology, and Government," David Z. Robinson
- "Better Use of Science in Science-based Regulation," Douglas Costle
- "Science in the Courthouse," Maurice Rosenberg
- "Science and Technology Analysis at the Congressional Support Agencies," John H. Gibbons
- "Responding to the Environment and the Economy Together," H. Guyford Stever
- "The Role of Science and Technology in Economic Performance," Lewis M. Branscomb
- "New Thinking and American Defense Technology," Ashton B. Carter
- "Dual-Use Technologies in the Military and Commercial Domains," Charles A. Zraket

*New York Academy of Sciences*

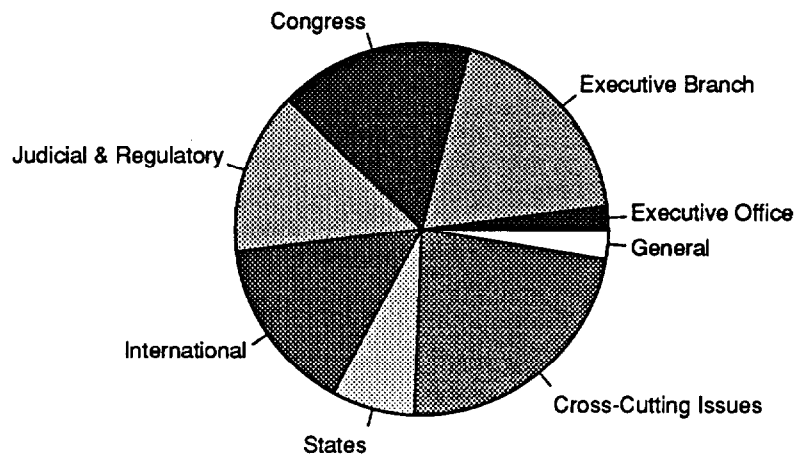
The New York Academy of Sciences created the Science Policy Association in 1985 as a means of bringing together the relatively large number of New Yorkers interested in Science Policy. The Commission is a cosponsor of

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the Association's principal activity which is to have monthly breakfasts at which a national leader in the science policy field speaks. The lectures are followed by questions. About fifty participants come to the meetings which have been informative and lively. Participants have been able to keep up with the thinking of leading government and industrial figures as a result.



Total Budget - FY 91; \$2,350,000



Programs Budget - FY 91; \$901,840

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## **PART III**

### **ADMINISTRATION**

#### **PERSONNEL**

The Commission has 22 members (see Appendix A) and an Advisory Council of 30 members (see Appendix B). About half of the Commission and Advisory Council members are scientists or engineers who have had experience in government or working closely with government agencies. The rest are individuals with broad experience in society and government who have worked closely with scientists. The Commission has been guided by two co-chairs, Joshua Lederberg and William Golden, and by an Executive Committee consisting of Helene Kaplan, Rodney Nichols, David Hamburg, and David Robinson in addition to the co-chairs.

The Commission has a staff of 12 with offices at New York University, The Rockefeller University, and Washington, D.C. (see Appendix C). In addition, there are task force staff at the Carter Center in Atlanta and at the Kennedy School at Harvard. Finally, the Commission has senior consultants who work with Commission members and staff across a wide range of program areas.

#### **FINANCES**

The Commission spent about \$400,000 in Fiscal Year 1988 which end September 30, 1988, about \$1.2 million in FY 1989, and about \$1.9 million in FY 1990.

The total budget request for FY 1991 is \$2.35 million. Approximately 38% of the total will fund the specific program activities described in Part II, including task force activities, consultants, reports, and program-related staff expenses. 35% will fund staff salaries and benefits; 16% will be used for facilities and administrative expenses; 8% will be used for Commissioners' honoraria and expenses; and 2% has been set aside as a contingency.

Approximately 23% of the program budget (which totals \$902,000) will fund the cross-cutting issues of Personnel, Nongovernmental Organizations, and Long-term S&T Goals and Priorities; 19% will be used to support the Executive Branch issue areas of Economic Performance, Education, and



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Environmental R&D. 17% will fund Committee on Congress activities; 15% is targeted for International activities; 14% will be used for the Judicial and Regulatory program; 7% will go to the new States task force; 2% will support Executive Office of the President activities; and 3% will fund general activities.